

Name _____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 1) Herpetologists (snake specialists) found that a certain species of reticulated python has an average length of 20.5 feet with a standard deviation of 2.3 feet. The scientists collect a random sample of 30 adult pythons and measure their lengths. In their sample the mean length was 19.5 feet long. One of the herpetologists fears that pollution might be affecting the natural growth of the pythons. Do you think this sample result is unusually small? Explain. 1) _____
- 2) According to Gallup, about 33% of Americans polled said they frequently experience stress in their daily lives. Suppose you are in a class of 45 students. 2) _____
- a. What is the probability that no more than 12 students in the class will say that they frequently experience stress in their daily lives? (Make sure to identify the sampling distribution you use and check all necessary conditions.)
- b. If 20 students in the class said they frequently experience stress in their daily lives, would you be surprised? Explain, and use statistics to support your answer.
- 3) Wildlife scientists studying a certain species of frogs know that past records indicate the adults should weigh an average of 118 grams with a standard deviation of 14 grams. The researchers collect a random sample of 50 adult frogs and weigh them. In their sample the mean weight was only 110 grams. One of the scientists is alarmed, fearing that environmental changes may be adversely affecting the frogs. Do you think this sample result is unusually low? Explain. 3) _____
- 4) It is generally believed that electrical problems affect about 14% of new cars. An automobile mechanic conducts diagnostic tests on 128 new cars on the lot. 4) _____
- a. Describe the sampling distribution for the sample proportion by naming the model and telling its mean and standard deviation. Justify your answer.
- b. Sketch and clearly label the model.
- c. What is the probability that in this group over 18% of the new cars will be found to have electrical problems?
- 5) All 423 Wisconsin public schools were all given a rating by the Wisconsin Department of Public Instruction based on several variables. The mean rating reported was 71.5 and the standard deviation was 4.87. To do a follow-up study a random sample of 40 schools was selected. In this sample, the mean rating was 70.9. One of the researchers is alarmed, thinking the report may have been mistaken. Do you think this sample result is unusually low? Explain. 5) _____

The countries of Europe report that 46% of the labor force is female. The United Nations wonders if the percentage of females in the labor force is the same in the United States. Representatives from the United States Department of Labor plan to check a random sample of over 10,000 employment records on file to estimate a percentage of females in the United States labor force.

- 6) The representatives from the Department of Labor want to estimate a percentage of females in the United States labor force to within $\pm 5\%$, with 90% confidence. How many employment records should they sample? 6) _____

A statistics professor asked her students whether or not they were registered to vote. In a sample of 50 of her students (randomly sampled from her 700 students), 35 said they were registered to vote.

- 7) What is the probability that the true proportion of the professor's students who were registered to vote is in your confidence interval? 7) _____

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- 8) Interpret the confidence interval in this context. 8) _____

A statistics professor asked her students whether or not they were registered to vote. In a sample of 50 of her students (randomly sampled from her 700 students), 35 said they were registered to vote.

- 9) Explain what 95% confidence means in this context. 9) _____

- 10) Find a 95% confidence interval for the true proportion of the professor's students who were registered to vote. (Make sure to check any necessary conditions and to state a conclusion in the context of the problem.) 10) _____

A report on health care in the US said that 28% of Americans have experienced times when they haven't been able to afford medical care. A news organization randomly sampled 801 black Americans, of whom 38% reported that there had been times in the last year when they had not been able to afford medical care. Does this indicate that this problem is more severe among black Americans?

- 11) Test an appropriate hypothesis and state your conclusion. (Make sure to check any necessary conditions and to state a conclusion in the context of the problem.) 11) _____

According to the 2010 U.S. Census, 11.7% of the people in the state of Oregon were Hispanic or Latino. A political party wants to know how much impact the Hispanic and Latino vote will have, so they wonder if that percentage has changed since then. They take a random sample of 853 adults in Oregon and ask, among other things, their race. 113 of the people surveyed were Hispanic or Latino. Can the political party conclude that the Hispanic proportion of the population has changed since 2010?

- 12) Test an appropriate hypothesis and state your conclusion. 12) _____

A company claims to have invented a hand-held sensor that can detect the presence of explosives inside a closed container. Law enforcement and security agencies are very interested in purchasing several of the devices if they are shown to perform effectively. An independent laboratory arranged a preliminary test. If the device can detect explosives at a rate greater than chance would predict, a more rigorous test will be performed. They placed four empty boxes in the corners of an otherwise empty room. For each trial they put a small quantity of an explosive in one of the boxes selected at random. The company's technician then entered the room and used the sensor to try to determine which of the four boxes contained the explosive. The experiment consisted of 50 trials, and the technician was successful in finding the explosive 16 times. Does this indicate that the device is effective in sensing the presence of explosives, and should undergo more rigorous testing?

13) Was your test one-tail upper tail, lower tail, or two-tail? Explain why you chose that kind of test in this situation. 13) _____

14) Test an appropriate hypothesis and state your conclusion. 14) _____

The International Olympic Committee states that the female participation in the 2004 Summer Olympic Games was 42%, even with new sports such as weight lifting, hammer throw, and modern pentathlon being added to the Games. Broadcasting and clothing companies want to change their advertising and marketing strategies if the female participation increases at the next games. An independent sports expert arranged for a random sample of pre-Olympic exhibitions. The sports expert reported that 202 of 454 athletes in the random sample were women. Is this strong evidence that the participation rate may increase?

15) Was your test one-tail upper tail, lower tail, or two-tail? Explain why you choose that kind of test in this situation. 15) _____

The owner of a small clothing store is concerned that only 28% of people who enter her store actually buy something. A marketing salesman suggests that she invest in a new line of celebrity mannequins (think Seth Rogan modeling the latest jeans...). He loans her several different "people" to scatter around the store for a two-week trial period. The owner carefully counts how many shoppers enter the store and how many buy something so that at the end of the trial she can decide if she'll purchase the mannequins. She'll buy the mannequins if there is evidence that the percentage of people that buy something increases.

16) The owner talked the salesman into extending the trial period so that she can base her decision on data for a full month. Will the power of the test increase, decrease, or remain the same? 16) _____

17) Over the trial month the rate of in-store sales rose to 30% of shoppers. The store's owner decided this increase was statistically significant. Now that she's convinced the mannequins work, why might she still choose not to purchase them? 17) _____

The board of directors for Procter and Gamble is concerned that only 19.5% of the people who use toothpaste buy Crest toothpaste. A marketing director suggests that the company invest in a new marketing campaign which will include advertisements and new labeling for the toothpaste. The research department conducts product trials in test markets for one month to determine if the market share increases with new labels.

18) Describe to the board of directors an advantage and a disadvantage of using a 5% alpha level of significance instead. 18) _____

According to the 2010 census, 20.3% of the population of the United States (ages 5 and up) live in a home in which a language other than English is spoken. Advocates for providing government programs to assist non-English speakers are convinced that, with the increasing non-white population in the United States, this proportion has probably increased. They plan to conduct a survey, and if they find the proportion of people who live in such homes has increased, they will organize a campaign to increase government investment in these assistance programs.

- 19) Describe to the owner an advantage and a disadvantage of using an alpha level of 5% instead. 19) _____

A company manufacturing computer chips finds that 8% of all chips manufactured are defective. Management is concerned that employee inattention is partially responsible for the high defect rate. In an effort to decrease the percentage of defective chips, management decides to offer incentives to employees who have lower defect rates on their shifts. The incentive program is instituted for one month. If successful, the company will continue with the incentive program.

- 20) Over the trial month, 6% of the computer chips manufactured were defective. Management decided that this decrease was significant. Why might management might choose not to permanently institute the employee incentive program? 20) _____

Pew Research found that, in 2013, 50% of American adults favored allowing same-sex couples to marry legally. This is up from 48% in 2012. The 2013 estimate was based on a random sample of 1,501 adults. Assume the same sample size was used in 2012. [*"Changing Attitudes on Gay Marriage," Pew Internet and American Life Project, June 2013.*]

- 21) Does this interval provide evidence that the proportion of people who favor allowing same-sex couples to marry has increased? 21) _____

Researchers conduct a study to test a potential side effect of a new allergy medication. A random sample of 160 subjects with allergies was selected for the study. The new "improved" Brand I medication was randomly assigned to 80 subjects, and the current Brand C medication was randomly assigned to the other 80 subjects. 14 of the 80 patients with Brand I reported drowsiness, and 22 of the 80 patients with Brand C reported drowsiness.

- 22) Does the interval in question 1 provide evidence that the side effect of drowsiness is different with the new medication? 22) _____

- 23) Compute a 95% confidence interval for the difference in proportions of subjects reporting drowsiness. Show all steps. 23) _____

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- 24) Compute and interpret a 95% confidence interval for the difference in the proportion of all American adults who favor allowing same-sex couples to marry. 24) _____

- 25) Because it is known that support for allowing same-sex couples to marry has been rising, it would be reasonable to perform a one-sided hypothesis test with the alternative hypothesis that the proportion of Americans who favor allowing such marriages is greater in 2013 than 2012. Would such a test cause you to reach the same conclusion you reached in question 3? 25) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 26) A relief fund is set up to collect donations for the families affected by recent storms. A random sample of 400 people shows that 28% of those 200 who were contacted by telephone actually made contributions compared to only 18% of the 200 who received first class mail requests. Which formula calculates the 95% confidence interval for the difference in the proportions of people who make donations if contacted by telephone or first class mail? 26) _____

A) $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.23)(0.77)}{200}}$

B) $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.23)(0.77)}{200} + \frac{(0.23)(0.77)}{200}}$

C) $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.28)(0.72)}{400} + \frac{(0.18)(0.82)}{400}}$

D) $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.28)(0.72)}{200} + \frac{(0.18)(0.82)}{200}}$

E) $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.23)(0.77)}{400}}$

- 27) A college alumni fund appeals for donations by phoning or emailing recent graduates. A random sample of 300 alumni shows that 40% of the 150 who were contacted by telephone actually made contributions compared to only 30% of the 150 who received email requests. Which formula calculates the 98% confidence interval for the difference in the proportions of alumni who may make donations if contacted by phone or by email? 27) _____

A) $(0.40 - 0.30) \pm 2.33\sqrt{\frac{(0.35)(0.65)}{300}}$

B) $(0.40 - 0.30) \pm 2.33\sqrt{\frac{(0.40)(0.60)}{150} + \frac{(0.30)(0.70)}{150}}$

C) $(0.40 - 0.30) \pm 2.33\sqrt{\frac{(0.35)(0.65)}{150} + \frac{(0.35)(0.65)}{150}}$

D) $(0.40 - 0.30) \pm 2.33\sqrt{\frac{(0.40)(0.60)}{300} + \frac{(0.30)(0.70)}{300}}$

E) $(0.40 - 0.30) \pm 2.33\sqrt{\frac{(0.35)(0.65)}{150}}$

- 28) A certain population is bimodal. We want to estimate its mean, so we will collect a sample. Which should be true if we use a large sample rather than a small one? 28) _____
- I. The distribution of our sample data will be clearly bimodal.
- II. The sampling distribution of the sample means will be approximately normal.
- III. The variability of the sample means will be smaller.

- A) I, II, and III
- B) II only
- C) I only
- D) III only
- E) II and III

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 29) Employment program A city council must decide whether to fund a new "welfare-to-work" program to assist long-time unemployed people in finding jobs. This program would help clients fill out job applications and give them advice about dealing with job interviews. A six-month trial has just ended. At the start of this trial a number of unemployed residents were randomly divided into two groups; one group went through the help program and the other group did not. Data about employment at the end of this trial are shown in the table. Should the city council fund this program? Test an appropriate hypothesis and state your conclusion.

	<u>Current job status</u>	
	Employed	Unemployed
Group 1 (Help program)	20	34
Group 2 (No help)	13	33

29) _____

- 30) Cereal A box of Raspberry Crunch cereal contains a mean of 13 ounces with a standard deviation of 0.5 ounce. The distribution of the contents of cereal boxes is approximately Normal. What is the probability that a case of 12 cereal boxes contains a total of more than 160 ounces?

30) _____